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THE WEB OF LIFE.

Tierbau und Tierleben in ihrem Zusammenhang betrachtet. By Prof. Dr. F. Hesse and Prof. Dr. F. Doflein. Band ii. Das Tier als Glied des Naturganzen. By Franz Doflein. Pp. xv + 960 + plates. (Leipzig and Berlin: B. G. Teubner, 1914.) Price 20 marks.

ONE of the fundamental ideas of biology, which found many illustrations in the work of Darwin, is that of the inter-relatedness of organisms in the web of life Just as there is a correlation of organs in the body, so there is a correlation of organisms in the economy of nature. No creature lives or dies to itself; the orbit of one life influences many others; everywhere we find linkages and wheels within wheels. An organism is compared by Prof. Doflein to a modern house, connected by various pipes and wires with other houses in the city and with the outer world, but the image is crude and too static. It is only in man's personal affairs that we find anything like the manifold, intricate, and subtle inter-relations that are to be seen in vigorous animals leading a full life. It is, indeed, altogether a matter of action and reaction between organism and environment, but with what complexity and nuance! Now things are in the saddle coercing the organism, and again the living creature exercises its prerogative and becomes master of its fate.

Prof. Doflein, Weismann's successor at Freiburg, has been studying this aspect of animal biology for more than ten years, and has given us his results in a work which must be placed in the front rank among ecological or bionomic studies. The book is nothing short of a great achievement. It has gathered interesting material from many fields; it includes much that is personal; it has worked out a clear classification of the manifold inter-relations; it is written in a vivid style; and if we said all we think about the abundance, freshness, and beauty of the illustrations, we should not be believed. We do not know of any British, American, or French book of natural history that even approaches it—a fact doubtless implying a smaller purchasing public. Prof. Doflein is well known for his work on the Protozoa and as a naturalist-traveller, and it is remarkable that he should have found time during the last ten years to write this large volume, a fit companion to its predecessor, by Prof. Hesse of Bonn, which treated of the organism as an individual.

In dealing with the comprehensive subject of the inter-relations of animals in the web of life, Prof. Doflein has evidently had in his mind throughout two allied, but distinct, general conceptions. The first is that of the organism as a bundle of adaptations to normal circumstances—what he calls "organisatorische Anpassungen"; the second is that of the organism as a self-assertive plastic agent, which can adjust itself to environmental vicissitudes—what he calls "regulatorische Anpassungen." The first is the hereditary racial equipment of wrought-out adaptations (as far as these concern give-and-take with animate and inanimate surroundings); the second is the individual capacity for adjustment, for modification, for thrusting as well as parrying. In both cases the adaptiveness may be structural, or functional, or psychical. Thus a ptarmigan from the mountains has a stronger heart than a willow-grouse from the plains—a structural adaptation. A bird or mammal continuously and normally regulates its production of heat according to its loss—a functional adaptation. Ants have an instinctive behaviour in relation to their queens —a psychical adaptation. But when a mammal transported to a cold country puts on a thicker coat, or when a bird adjusts the nature of its food-canal to altered diet, or when ants taken from Algiers to Switzerland entirely alter the door of the nest (in relation to new enemies), we have to deal with structural, functional, and psychical adjustments which are not more than individual reactions. This distinction between racial adaptation and individual adjustment is prominent in the book, but the author does not use it stiffly. He is clear, for instance, that the individual trades with his talents.

Beginning with the animate environment, Prof. Doflein deals with nutritive relations (including symbiosis, commensalism, parasitism, etc.); relations to enemies (including protective resemblance, mimicry, autotomy, etc.); sex-relations; migrations; care of offspring; social relations (including gregariousness, co-operation, and the communities of ants, bees, and termites). After 750 pages on these attractive themes, he passes to the inanimate environment, and deals with cosmic periodicities, the medium, the substratum, pressures, chemical influences, the quantity and quality of the food, temperature, climate, and light. This part of the book is like Semper's well-known work, "The Natural Conditions of Existence as they affect Animal Life" (1881), brought up to date. The volume ends with a discussion of the theoretical significance of adaptive structures and habits. What is new is the synthetic treatment of the whole question of inter-relatedness, which is, of course, fundamental in any biology

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worthy of the name, and the wealth of fresh material that the author has collected from far and near. Among the interesting plates, we may refer to those illustrating symbiosis, protective coloration, wild geese, the courtship of capercaillie and blackcock, cave animals, and phosphorescence.

As we pass from this valuable treasury of bionomics, many reflections rise. We recognise the impossibility of understanding details of structure apart from details of environment—a commonplace, of course, but illumined by some of the subtle instances that Doflein gives. We appreciate the light that the manifold inter-relatedness of organisms throws on the value of even small variations. The selective process has to be envisaged in relation to the web of life. We realise afresh the importance of the organism's active agency. It is modified by its environment and it is adapted to its environment; but there is more, it actually adapts the environment to itself. And, finally, we are filled once more with wonderment at the vision of life slowly creeping upwards through unthinkable ages, asserting itself insurgently amid a callous physical nature. All that the author of this fine work has told us confirms the impression of a deep tendency to inter-linking and systematisation—the Darwinian *systema naturae*—which is more than a mere image of what obtains increasingly, in spite of all rendings of the web, in the progress of mankind.

J. ARTHUR THOMSON.

ASSAYING AT THE ROYAL SCHOOL OF MINES.

Assaying in Theory and Practice. By E. A. Wraight. Pp. xi+323. (London: Edward Arnold, 1914.) Price 10*s*. 6*d*. net.

THIS book will be welcomed by all assayers who appreciate the value of the teaching at the Royal School of Mines, and is of special interest to old students of the School, for the reason that it gives an account of the methods of assaying which have been taught there during the last few years. Almost all the notes issued to the students in the laboratory are contained in the book, and, in addition, besides other matter, the author gives some general remarks which will be of use to mine assayers and prospectors. Mr. Wraight is well equipped for the task of reminding his former students of what he has taught them. He was for some years the senior demonstrator in the assay laboratory of the Royal School of Mines, and in that capacity has been able to command the attention and affectionate respect of all who have come under his guidance. His work has only recently passed into other hands.

Mr. Wraight has made no attempt to write a complete book on assaying. The number of methods given is comparatively small and the gaps are considerable. For example, no mention is made of the volumetric methods of assay of silver bullion, or of the dry method for antimony, or of any method at all for platinum. The author observes that he has some thoughts of preparing a second volume containing analyses of ores, slags, etc., and of iron and steel. It may be hoped that he will include in it much besides these important sections.

As might be expected by those who know the author's work, there are few mistakes to be found in the book, and none of much importance. The method of determining silver in gold bullion given on p. 153 is an untrustworthy one, which is becoming obsolete. The method of parting with cadmium is not given. On p. 182 it is stated that graphite is not attacked by basic oxides. On p. 297, in the estimation of protective alkali in cyanide solutions, a decinormal solution of nitric acid is recommended instead of the usual oxalic acid or the fairly satisfactory sulphuric acid. The book certainly deserves a place on the shelf of works assayers. As a concise and clear statement of well-tried methods, it could scarcely be improved.

T. K. R.

JAPANESE MATHEMATICS.

A History of Japanese Mathematics. By D. E. Smith and Yoshio Mikami. Pp. vii+288. (Chicago and London: The Open Court Publishing Co., 1914.) Price 12*s*. net.

NOW that Europeans are becoming acquainted with the history of mathematics in Japan, it is possible for them to form a kind of general opinion about the work of Japanese mathematicians. Unless future research bring to light works of a calibre superior to those now known, we must acquiesce in the conclusions stated in the terminal pages of the present work. Briefly, they are that Japan has not originated any great and far-reaching theory, such as the infinitesimal calculus, or function-theory, or group-theory; while on the other hand, native methods of great ingenuity, applied to particular problems, did lead to equivalents for such things as Horner's method in solving equations, the general rule for computing a determinant, and a large number of ways of calculating π, some including the use of infinite series.

Another thing in which the older Japanese mathematicians excel is in dealing with a set of

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